APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/674,676	09/30/2003	Marc A. Najork	MSFT-2557/304882.01	4999

41505   7590   10/22/2009
WOODCOCK WASHBURN LLP (MICROSOFT CORPORATION)
CIRA CENTRE, 12TH FLOOR
2929 ARCH STREET
PHILADELPHIA, PA 19104-2891

EXAMINER
STACE, BRENT S

ART UNIT	PAPER NUMBER
2161	

MAIL DATE	DELIVERY MODE
10/22/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

	Application No.	**Applicant(s)**
Office Action Summary	10/674,676	NAJORK ET AL.
	Examiner	**Art Unit**	
	BRENT STACE	2161	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS,
WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *26 August 2009*.

2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1,2,4-6,9,10,12,14-16,19,20,22-27,29,30,32-34,37,38 and 40-56* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1,2,4-6,9,10,12,14-16,19,20,22-27,29,30,32-34,37,38 and 40-56* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *30 June 2006* is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All b) ☐ Some * c) ☐ None of:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Remarks

1.   This communication is responsive to the amendment filed August 26th, 2009.

Claims 1, 2, 4-6, 9, 10, 12, 14-16, 19, 20, 22-27, 29, 30, 32-34, 37, 38, and 40-56 are

pending. In the amendment filed August 26th, 2009, Claims 1, 4-6, 9, 12, 14-16, 19, 22,

26, 29, 30, 32-34, 37, 38, 40-46, 50, 51, 53, and 55 are amended, Claims 3, 7, 8, 11,

13, 17, 18, 21, 28, 31, 35, 36, and 39 are canceled, and Claims 1, 12, 22, 29, 38, 46,

51, 53, and 55 are independent.

Continued Examination Under 37 CFR 1.114

2.   A request for continued examination under 37 CFR 1.114, including the fee set

forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this

application is eligible for continued examination under 37 CFR 1.114, and the fee set

forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action

has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/26/09

has been entered.

Response to Arguments

3.   The Applicant's remarks filed August 26th, 2009 with respect to Claims 1, 2, 4-6,

9, 10, 12, 14-16, 19, 20, 22-27, 29, 30, 32-34, 37, 38, and 40-56 have been fully

considered but they are not persuasive. See below for a detailed response.

4.   As to Applicant's arguments with respect to exemplary Claim 1 (including Claims

12, 22, 29, 38, 46, 51, 53, and 55) for the prior art(s) allegedly not disclosing "**storing**

said plurality of log entries in a single log" as recited in amended independent

claims 1 and 12, "maintaining a single log, where the single log is partitioned into

an upper layer and an allocation layer" as recited in independent claims 22 and

55, "a single storage log for storing said plurality of log entries" as recited in

amended independent claim 29, "a single finite storage log for storing said

plurality of log entries" as recited in amended independent claim 38, "the single

log is partitioned into an upper layer and an allocation layer" as recited in

independent claim 46, "storing said plurality of log entries into a single log" as

recited in amended independent claim 51, or "storing said plurality of log entries

into a single finite log" as recited in amended independent claim 53," the examiner

respectfully disagrees. Applicant's specification, paragraph 78 provides support for this

amendment and provides additional clarity. Applicant's paragraph 78 specifies that a

single log is used and is partitioned instead of there being multiple logs (one log for the

allocation layer and another for the b-link tree layer (or upper layer)). Lomet's Rlog is

one log. It is partially persistent in that some of it is buffered (volatile) on client storage,

and some of it is on shared disk persistent storage. The allocation layer is the block

allocations/frees in the Rlog data and the b-link tree layer is in the Rlog data also in the

updates/deletes, etc. it does to the data (being in Lehman's B-link tree). Since the

claimed "upper layer" is not related to a b-link tree structure, the upper layer is

considered as any rlog data not being the allocation layer of the rlog (this is why

Lehman is not used in the rejections for Claims 22, 23, 26, 27, 46, 47, 50, 55 and 56

below).

      Claims 22, 46 and 55 are claiming slightly different subject matter than the other

independent claims in that, for instance, Claim 22 claims "maintaining a single log,

where the single log is partitioned into an upper layer and an allocation layer, at each of

said first and second server locations." With this claim's wording, it was interpreted as

requiring a single log at multiple locations. Shaheen, col. 4, lines 62-66 was prior art

brought in to teach this limitation. In the cited section, Shaheen teaches merging logs

from servers and sending the single merged log back to the servers (Lomet appears to

support this design with Lomet, col. 5, lines 57-58). This, combined with Lomets's

Rlogs teaches that the Rlog is merged and the merged rlog is pushed back to the

computers, thus making a single rlog at multiple locations.

5.   The other claims argued merely because of a dependency on a previously

argued claim(s) in the arguments presented to the examiner, filed August 26th, 2009,

are moot in view of the examiner's interpretation of the claims and art and are still

considered rejected based on their respective rejections from at least a prior Office

action (part(s) of recited again below).

Specification

6.   The lengthy specification has not been checked to the extent necessary to

determine the presence of all possible minor errors. Applicant's cooperation is

requested in correcting any errors of which applicant may become aware in the

specification.

Claim Objections

7.   In light of the applicant's respective arguments or respective amendments, the

previous claim objections to the claims have been withdrawn.

Claim Rejections - 35 USC § 103

8.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

9.   This application currently names joint inventors. In considering patentability of

the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

the various claims was commonly owned at the time any inventions covered therein

were made absent any evidence to the contrary. Applicant is advised of the obligation

under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to

consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g)

prior art under 35 U.S.C. 103(a).

10.   Claims 1, 2, 4-6, 9, 10, 12, 14-16, 19, 20, 29, 30, 32-34, 37, 38, 40-45, and 51-54

are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No.

5,485,608 (Lomet et al.) in view of "Efficient Locking for Concurrent Operations on B-

Trees" (Lehman et al.).

    For **Claim 1**, Lomet teaches: "A method for logging while updating...via a

plurality of data transactions, [Lomet, col. 7, lines 26-34, write ahead logging – log

written before blocks during update process] comprising:

- generating a plurality of log entries corresponding to a plurality of data

    transactions, the data transactions to be carried out on a plurality of nodes of a

    B-link tree, wherein the data transactions are associated with a single B-link tree

    operation on said B-link tree, [Lomet, col. 1, lines 29-48 with Lomet, col. 22, lines

    25-30 with Lomet, col. 19, lines 35-37, (b-link tree taught by lehman below) log

    records created when updating (e.g. Rlog)] wherein said plurality of log entries

    include at least one entry from an allocation layer [Lomet, col. 1, lines 65-67 with

    Lomet, col. 5, lines 38-44, Rlog data entry for block alloc's/frees] and at least one

    entry from a B-link tree layer, [Lomet, col. 19, lines 35-37 with Lomet, col. 5, lines

    38-44, action (e.g. update, delete) done to Lehman's b-Link tree] wherein said at

    least one entry from said allocation layer is local to its corresponding computing

    device of a plurality of computing devices [Lomet, col. 2, lines 50-53 with Lomet,

    col. 5, lines 51-62, separate RLog for each computer node] and said at least one

    entry from said B-link tree is replicated among said plurality of computing

devices; [Lomet, col. 2, lines 11-16, B-link tree database data shipped to requesting computers to respond to requests]

- storing said plurality of log entries in a single log, the single log being a partially persistent log, wherein a tail of said partially persistent log is in a memory, and said partially persistent log comprises of said memory and a persistent storage; [Lomet, col. 4, lines 28-30 with Lomet, col. 4, lines 64-67 with Lomet, col. 5, lines 1-3 with Lomet, col. 12, lines 20-23 with Lomet, col. 7, lines 26-34 with Lomet, col. 19, lines 35-37, Rlog of entries is singular to each node where its tail is buffered (e.g. volatile), then the Rlog is flushed to one persistent shared Rlog disk when associated transaction committs]

- associating said plurality of log entries with each other for determining whether the single B-link tree operation has been completed; [Lomet, col. 1, lines 29-48 with Lomet, col. 22, lines 25-30 with Lomet, col. 19, lines 35-37, logged changes associated with a transaction] and

- wherein a boundary between said memory and said persistent storage in said partially persistent log varies over time" [Lomet, col. 4, lines 28-30 with Lomet, col. 4, lines 64-67 with Lomet, col. 5, lines 1-3 with Lomet, col. 12, lines 20-23 with Lomet, col. 19, lines 35-37 with Lomet, col. 16, lines 23-25 see also Lomet, col. 19, lines 45-51 with Lomet, col. 20, lines 20-26, Rlog buffer occasionally (when commits) flushes entries to persistent storage. This can be viewed as a boundary varying over time (as new transactions start and others commit over time by database usage)].

Lomet discloses the above limitations but does not expressly teach:

- "...a B-link tree."

With respect to Claim 1, an analogous art, Lehman, teaches:

- "...a B-link tree" [Lehman, p. 657, section 3.3, b-trees (specifically including b-link trees are favorable for database applications].

It would have been obvious to one of ordinary skill in the art at the time of invention to combine Lehman with Lomet because both inventions are directed towards storing information in a database.

Lehman's invention would have been expected to successfully work well with Lomet's invention because both inventions use databases. Lomet discloses methods and an apparatus for updating information in a computer system using logs and state identifiers comprising Rlogs, Ulogs and Alogs, however Lomet does not expressly disclose the use of a B-link-tree to store the data in the database of Lomet. Lehman discloses efficient locking for concurrent operations on B-trees comprising a B-link-tree.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the b-link-tree from Lehman and install it into the invention of Lomet, thereby offering the obvious advantage of a guaranteed small (average) search, insertion, and deletion time for the database of Lomet (see front page of Lehman).

Claim 2 can be mapped to Lomet (as modified by Lehman) as follows: "A method according to claim 1, further including periodically truncating the log" [Lomet, cols. 11-12, lines 60-12].

Claim 4 can be mapped to Lomet (as modified by Lehman) as follows: "A method according to claim 1, further including discarding one of the log entries from the log when the corresponding data transaction has been carried out on said B-link tree" [Lomet, col. 14, lines 9-12].

Claim 5 can be mapped to Lomet (as modified by Lehman) as follows: "A method according to claim 1, wherein said storing includes storing said log entries into the log before the corresponding data transactions are carried out on said B-link tree" [Lomet, col. 7, lines 26-34].

Claim 6 can be mapped to Lomet (as modified by Lehman) as follows: "A method according to claim 1, further including caching data of said data transactions before said data transactions are carried out on said B-link tree" [Lomet, col. 7, lines 26-34 with Lomet, col. 5, lines 1-11].

Claim 9 can be mapped to Lomet (as modified by Lehman) as follows: "A method according to claim 1, further including maintaining a log sequence number with each of said plurality of log entries, uniquely identifying one of the log entries" [Lomet, col. 5, lines 44-52].

Claim 10 encompasses substantially the same scope of the invention as that of Claim 1, in addition to computer readable medium and some instructions for performing the method steps of Claim 1. Therefore, Claim 10 is rejected for the same reasons as stated above with respect to Claim 1.

For **Claim 12**, Lomet teaches: "A method for logging while updating…via a plurality of data transactions, [Lomet, col. 7, lines 26-34] comprising:

- generating a plurality of log entries corresponding to a plurality of data transactions, the data transactions to be carried out on a plurality of nodes of a B-link tree, wherein the data transactions are associated with a single B-link operation on said B-link tree, [Lomet, col. 1, lines 29-48 with Lomet, col. 22, lines 25-30 with Lomet, col. 19, lines 35-37 with Lomet, col. 19, lines 45-51] wherein said plurality of log entries include at least one entry from an allocation layer [Lomet, col. 1, lines 65-67 with Lomet, col. 5, lines 38-44] and at least one entry from a B-link tree layer, [Lomet, col. 19, lines 35-37 with Lomet, col. 5, lines 38-44] wherein said at least one entry from said allocation layer is local to its corresponding computing device of a plurality of computing devices [Lomet, col. 2, lines 50-53 with Lomet, col. 5, lines 51-62] and said at least one entry from said B-link tree is replicated among said plurality of computing devices; [Lomet, col. 2, lines 11-16]

- storing said plurality of log entries in a <u>single log, the single log being a</u> partially persistent log, wherein a tail of said partially persistent log is in a memory, and said partially persistent log comprises of said memory and a persistent storage; [Lomet, col. 4, lines 28-30 with Lomet, col. 4, lines 64-67 with Lomet, col. 5, lines 1-3 with Lomet, col. 12, lines 20-23 with Lomet, col. 7, lines 26-34 with Lomet, col. 19, lines 35-37]

- associating said plurality of log entries with each other for determining whether the single B-link operation has been completed; [Lomet, col. 1, lines 29-48 with

Lomet, col. 22, lines 25-30 with Lomet, col. 19, lines 35-37 with Lomet, col. 19, lines 45-51] and

- wherein a boundary between said memory and said persistent storage in said partially persistent log varies over time [Lomet, col. 4, lines 28-30 with Lomet, col. 4, lines 64-67 with Lomet, col. 5, lines 1-3 with Lomet, col. 12, lines 20-23 with Lomet, col. 19, lines 35-37 with Lomet, col. 16, lines 23-25 see also Lomet, col. 19, lines 45-51 with Lomet, col. 20, lines 20-26]

- periodically flushing data corresponding to data transactions represented by the finite log to persistent storage; [Lomet, col. 14, lines 9-17] and

- truncating said finite log in coordination with said flushing" [Lomet, col. 14, lines 9-17].

  Lomet discloses the above limitations but does not expressly teach:

- "a B-link tree."

  With respect to Claim 12, an analogous art, Lehman, teaches:

- "a B-link tree" [Lehman, p. 657, section 3.3].

  It would have been obvious to one of ordinary skill in the art at the time of invention to combine Lehman with Lomet because both inventions are directed towards storing information in a database.

  Lehman's invention would have been expected to successfully work well with Lomet's invention because both inventions use databases. Lomet discloses methods and an apparatus for updating information in a computer system using logs and state identifiers comprising Rlogs, Ulogs and Alogs, however Lomet does not expressly

disclose the use of a B-link-tree to store the data in the database of Lomet. Lehman
discloses efficient locking for concurrent operations on B-trees comprising a B-link-tree.

It would have been obvious to one of ordinary skill in the art at the time of
invention to take the b-link-tree from Lehman and install it into the invention of Lomet,
thereby offering the obvious advantage of a guaranteed small (average) search,
insertion, and deletion time for the database of Lomet.

Claim 14 can be mapped to Lomet (as modified by Lehman) as follows: "A
method according to claim 12, further including discarding one of the log entries from
the finite log when the corresponding data transaction has been carried out on said B-
link tree" [Lomet, col. 14, lines 9-17].

Claim 15 can be mapped to Lomet (as modified by Lehman) as follows: "A
method according to claim 12, wherein said storing includes storing said log entries into
the finite log before the corresponding data transactions are carried out on said B-link
tree" [Lomet, col. 7, lines 26-34].

Claim 16 can be mapped to Lomet (as modified by Lehman) as follows: "A
method according to claim 12, further including caching data of said data transactions
before said data transactions are carried out on said B-link tree" [Lomet, col. 7, lines 26-
34 with Lomet, col. 5, lines 1-11].

Claim 19 can be mapped to Lomet (as modified by Lehman) as follows: "A
method according to claim 12, further including maintaining a log sequence number with
each of said plurality of log entries, uniquely identifying one of the log entries" [Lomet,
col. 5, lines 44-52].

Claim 20 encompasses substantially the same scope of the invention as that of Claim 12, in addition to computer readable medium and some instructions for performing the method steps of Claim 12. Therefore, Claim 20 is rejected for the same reasons as stated above with respect to Claim 12.

Claims 29 and 30 encompass substantially the same scope of the invention as that of Claims 1 and 2, respectfully, in addition to a server and some actions for performing the method steps of Claims 1 and 2, respectfully. Therefore, Claims 29 and 30 are rejected for the same reasons as stated above with respect to Claims 1 and 2, respectfully.

Claims 32-34 and 37 encompass substantially the same scope of the invention as that of Claims 4-6 and 9, respectfully, in addition to a server and some actions for performing the method steps of Claims 4-6 and 9, respectfully. Therefore, Claims 32-34 and 37 are rejected for the same reasons as stated above with respect to Claims 4-6 and 9, respectfully.

Claim 38 encompasses substantially the same scope of the invention as that of Claim 12, in addition to a server and some objects for performing the method steps of Claim 12. Therefore, Claim 38 is rejected for the same reasons as stated above with respect to Claim 12.

Claims 40-42 encompass substantially the same scope of the invention as that of Claims 14-16, respectfully, in addition to a server and some objects for performing the method steps of Claims 14-16, respectfully. Therefore, Claims 40-42 are rejected for the same reasons as stated above with respect to Claims 14-16, respectfully.

Claim 43 can be mapped to Lomet (as modified by Lehman) as follows: "A server according to claim 38, further including storing said plurality of log entries in an intermediate memory previous to storing said plurality of log entries in the finite storage log" [Lomet, col. 7, lines 26-34 with Lomet, col. 19, lines 35-37].

Claim 44 can be mapped to Lomet (as modified by Lehman) as follows: "A server according to claim 43, wherein said plurality of log entries are moved from intermediate memory to the finite storage log after the data transactions commit" [Lomet, col. 16, lines 23-25 see also Lomet, col. 19, lines 45-51 with Lomet, col. 20, lines 20-26].

Claim 45 encompasses substantially the same scope of the invention as that of Claim 19, in addition to a server and some objects for performing the method steps of Claim 19. Therefore, Claim 45 is rejected for the same reasons as stated above with respect to Claim 19.

Claims 51 and 52 encompass substantially the same scope of the invention as that of Claims 1 and 2, respectfully, in addition to a computing device and some means for performing the method steps of Claims 1 and 2, respectfully. Therefore, Claims 51 and 52 are rejected for the same reasons as stated above with respect to Claims 1 and 2, respectfully.

Claims 53 and 54 encompass substantially the same scope of the invention as that of Claims 12 and 14, respectfully, in addition to a computing device and some means for performing the method steps of Claims 12 and 14, respectfully. Therefore,

Claims 53 and 54 are rejected for the same reasons as stated above with respect to

Claims 12 and 14, respectfully.

11.   Claims 22, 23, 26, 27, 46, 47, 50, 55 and 56 are rejected under 35 U.S.C. 103(a)

as being unpatentable over U.S. Patent No. 5,485,608 (Lomet et al.) in view of U.S.

Patent No. 5,434,994 (Shaheen et al.).

        For **Claim 22**, Lomet teaches: "A method for logging while updating a data

structure via a plurality of data transactions, [Lomet, col. 7, lines 26-34] comprising:

- …generating a plurality of log entries corresponding to a plurality of data

   transactions, the data transactions to be carried out on said data structure,

   wherein the data transactions are associated with a single operation on the data

   structure; [Lomet, col. 1, lines 29-48 with Lomet, col. 22, lines 25-30 with Lomet,

   col. 19, lines 35-37 with Lomet, col. 19, lines 45-51] and

- …where the single log is partitioned into an upper layer and an allocation layer,

   [Lomet, col. 5, lines 31-45 with Lomet, Fig. 3] … wherein the single log includes

   log entries from both the upper layer and allocation layer [Lomet, col. 5, lines 15-

   22 with Lomet, Fig. 3]…wherein said entries from said allocation layer are local to

   its corresponding computing device of a plurality of computing devices [Lomet,

   col. 2, lines 50-53 with Lomet, col. 5, lines 51-62] and said entries from said

   upper layer are replicated among said plurality of computing devices; [Lomet, col.

   5, lines 51-62 with Lomet, col. 2, lines 11-16]

- associating said plurality of log entries with each other for determining whether the single operation on the data structure has been completed; [Lomet, col. 1, lines 29-48 with Lomet, col. 22, lines 25-30 with Lomet, col. 19, lines 35-37 with Lomet, col. 19, lines 45-51] and

- wherein said single log is a partially persistent log, where a tail of said partially persistent log is in a memory, and said partially persistent log comprises of said memory and a persistent storage" [Lomet, col. 4, lines 28-30 with Lomet, col. 4, lines 64-67 with Lomet, col. 5, lines 1-3 with Lomet, col. 12, lines 20-23 with Lomet, col. 7, lines 26-34 with Lomet, col. 19, lines 35-37].

  Lomet discloses the above limitations but does not expressly teach:

- "…replicating updates to the data structure to a first server location and a second server location;

- maintaining a single log…at each of said first and second server locations."

  With respect to Claim 22, an analogous art, Shaheen, teaches:

- "…replicating updates to the data structure to a first server location and a second server location; [Shaheen, col. 7, lines 50-55]

- maintaining a single log…at each of said first and second server locations" [Shaheen, col. 4, lines 62-66].

  It would have been obvious to one of ordinary skill in the art at the time of invention to combine Shaheen with Lomet because both inventions are directed towards recovering data upon failure.

Shaheen's invention would have been expected to successfully work well with Lomet's invention because both inventions use computers using logs. Lomet discloses methods and an apparatus for updating information in a computer system using logs and state identifiers comprising Rlogs, Ulogs and Alogs, however Lomet does not expressly disclose replicating data on multiple servers, or maintaining a single log on those servers. Shaheen discloses a system and method for maintaining replicated data coherency in a data processing system comprising replicating data and logs across multiple servers.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the replication of data and logs across multiple servers from Shaheen and install it into the invention of Lomet, thereby offering the obvious advantage of making Lomet distributed to increase the availability and reliability of distributed systems of Lomet (Shaheen, col. 1, lines 36-39).

Claim 23 can be mapped to Lomet (as modified by Shaheen) as follows: "A method according to claim 22, further including recovering the data structure after a failure by performing parallel recovery operations by each of said first and second server locations" [Shaheen, col. 4, lines 60-66 with Shaheen, col. 7, lines 49-57].

Claim 26 can be mapped to Lomet (as modified by Shaheen) as follows: "A method according to claim 22, wherein the allocation layer handles at least one of (A) an allocate disk space operation, (B) a deallocate disk space operation, (C) a read from the allocated disk space operation and (D) a write to the allocated disk space operation" [Lomet, col. 5, lines 31-38].

Claim 27 encompasses substantially the same scope of the invention as that of Claim 22, in addition to computer readable medium and some instructions for performing the method steps of Claim 22. Therefore, Claim 27 is rejected for the same reasons as stated above with respect to Claim 22.

Claims 46, 47, and 50 encompass substantially the same scope of the invention as that of Claims 22, 23, and 26, respectfully, in addition to a serer and some objects for performing the method steps of Claims 22, 23, and 26, respectfully. Therefore, Claims 46, 47, and 50 are rejected for the same reasons as stated above with respect to Claims 22, 23, and 26, respectfully. Additionally, Claim 46 has an additional limitation not found in Claim 22, but is also taught by Lomet : "wherein a boundary between said memory and said persistent storage in said partially persistent log varies over time" [Lomet, col. 4, lines 28-30 with Lomet, col. 4, lines 64-67 with Lomet, col. 5, lines 1-3 with Lomet, col. 12, lines 20-23 with Lomet, col. 19, lines 35-37 with Lomet, col. 16, lines 23-25 see also Lomet, col. 19, lines 45-51 with Lomet, col. 20, lines 20-26].

Claims 55 and 56 encompass substantially the same scope of the invention as that of Claims 22 and 23, respectfully, in addition to a computing device and some means for performing the method steps of Claims 22 and 23, respectfully. Therefore, Claims 55 and 56 are rejected for the same reasons as stated above with respect to Claims 22 and 23, respectfully. Additionally, Claim 55 recites "wherein said entries from the upper layer are replicated to both said first server and said second server, while said entries from said allocation layer are stored locally on said first server and said second server" which is taught by [Lomet, col. 2, lines 50-53 with Lomet, col. 5, lines 51-62 with

Lomet, col. 2, lines 11-16] (similar to the above claims). Also, Claim 55 recites "wherein

said single log is a partially persistent log that has a boundary that changes over time

between a persistent and non-persistent memory" which is taught by [Lomet, col. 4,

lines 28-30 with Lomet, col. 4, lines 64-67 with Lomet, col. 5, lines 1-3 with Lomet, col.

12, lines 20-23 with Lomet, col. 19, lines 35-37 with Lomet, col. 16, lines 23-25 see also

Lomet, col. 19, lines 45-51 with Lomet, col. 20, lines 20-26] (similar to the above

claims).

12.   Claims 24, 25, 48, and 49 are rejected under 35 U.S.C. 103(a) as being

unpatentable over U.S. Patent No. 5,485,608 (Lomet et al.) in view of U.S. Patent No.

5,434,994 (Shaheen et al.), further in view of Efficient Locking for Concurrent

Operations on B-Trees (Lehman et al.).

        For **Claim 24**, Lomet (as modified by Shaheen) teaches: "A method according to

claim 22."

        Lomet (as modified by Shaheen) discloses the above limitation but does not

expressly teach: "wherein said data structure is a B-link tree."

        With respect to Claim 24, an analogous art, Lehman, teaches: "wherein said data

structure is a B-link tree" [Lehman, p. 657, section 3.3].

        It would have been obvious to one of ordinary skill in the art at the time of

invention to combine Lehman with Lomet (as modified by Shaheen) because both

inventions are directed towards storing information in a database.

Lehman's invention would have been expected to successfully work well with Lomet (as modified by Shaheen)'s invention because both inventions use databases. Lomet (as modified by Shaheen) discloses methods and an apparatus for updating information in a computer system using logs and state identifiers comprising Rlogs, Ulogs and Alogs, however Lomet (as modified by Shaheen) does not expressly disclose the use of a B-link-tree to store the data in the database of Lomet (as modified by Shaheen). Lehman discloses efficient locking for concurrent operations on B-trees comprising a B-link-tree.

It would have been obvious to one of ordinary skill in the art at the time of invention to take the b-link-tree from Lehman and install it into the invention of Lomet (as modified by Shaheen), thereby offering the obvious advantage of a guaranteed small (average) search, insertion, and deletion time for the database of Lomet (as modified by Shaheen).

Claim 25 can be mapped to Lomet (as modified by Shaheen and Lehman) as follows: "A method according to claim 24, wherein the upper layer is a B-link tree layer that handles B-link tree operations" [Lomet, col. 5, lines 39-44].

Claims 48 and 49 encompass substantially the same scope of the invention as that of Claims 24 and 25, respectively, in addition to a server and some objects for performing the method steps of Claims 24 and 25, respectfully. Therefore, Claims 48 and 49 are rejected for the same reasons as stated above with respect to Claims 24 and 25, respectfully.

Conclusion

13.   Any prior art made of record and not relied upon is considered pertinent to

applicant's disclosure. Applicant is advised that, although not used in the rejections

above, prior art cited on any PTO-892 form and not relied upon is considered materially

relevant to the applicant's claimed invention and/or portions of the claimed invention.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to BRENT STACE whose telephone number is (571)272-

8372 and fax number is 571-273-8372. The examiner can normally be reached on M-F

9am-5:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Apu M. Mofiz can be reached on 571-272-4080. The fax phone number for

the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free).

/BRENT STACE/
Examiner, Art Unit 2161